WE CLAIM:

1. A method of amplifying an optical signal comprising:

splitting the optical signal into two path signals each having an external noise path component and a signal path component;

amplifying the path signals through independent amplification stages such that, after amplification, each path signal carries a respective ASE (amplified spontaneous emission) path component wherein the ASE path components are substantially un-correlated;

performing a respective phase adjustment to at least one of the path signals before or after amplification such that the signal path components of the path signals can be combined constructively at a combination point;

at the combination point, combining the path signals to produce an output optical signal.

2. A method according to claim 1 wherein the ASE path components being substantially un-correlated results in ASE power of the respective ASE path components being substantially divided between a main output and a subsidiary output.

3. A method according to claim 1 wherein the respective phase adjustment(s) is/are further performed in a manner such that, at the combination point, the external noise path components are at least partially incoherent resulting in external noise power being diverted to a subsidiary output.

4. A method according to claim 1 wherein a phase adjustment is applied to both path signals.

5. A method according to claim 1 wherein the respective phase adjustment(s) is/are applied by passing the path signals through respective OTM (optical transmission media) having different optical path lengths.

6. A method according to claim 1 wherein the respective phase adjustment(s) is(are) applied by controlling non-linear effects in an active gain region through which the path signals propagate.

7. A method according to claim 5 wherein an optical path length difference, ΔL_o, between the OTM is chosen to satisfy a symbol shift tolerance.

8. A method according to claim 1 wherein the respective phase adjustment(s) is/are achieved by employing an optical path length difference, ΔL_o, between the two path signals, the optical path length difference substantially satisfying $\Delta L_o \leq \chi C/\omega$ wherein C is the speed of light, ω is a carrier data rate of the input optical signal and χ is a symbol shift tolerance.

9. A method according to claim 7 wherein the external noise path components have a coherence length, L_c, and the phase adjustments are achieved by employing an optical path length difference, ΔL_o, between the two path signals, wherein if the coherence length, L_c, is less than a maximum optical path length difference, $\Delta L_{\max}$, the path signals can tolerate while satisfying the symbol shift tolerance then the optical path length difference substantially satisfies $L_c < \Delta L_o \leq \Delta L_{\max}$, otherwise the optical path length difference substantially satisfies $\Delta L_o \leq \Delta L_{\max}$.

10. A method according to claim 1 wherein the respective phase adjustment(s) result(s) in the signal path components of the path signals being substantially in phase with each other to an integral multiple of 2π.

11. A method according to claim 1 applied to an optical signal comprising a plurality of equally spaced channels wherein any two consecutive channels with frequencies f' and f of the equally spaced channels differ by $\Delta f = f' - f$ and wherein an optical path length difference, ΔL_o, between the two path signals, substantially satisfies $\Delta L_o = KC/(2\Delta f)$, wherein $K = 1, 2, 3, \ldots$ and C is the speed of light in vacuum.

12. An optical amplifier arrangement comprising:

an optical splitter, two OTM, a gain block within each one of the OTM and an optical coupler, wherein the optical splitter is adapted to split an optical signal into two path signals, each having a signal path component and a noise path component, that propagate through a respective one of the OTM, are amplified by a respective one of the gain blocks and recombined through the optical coupler; and

a phase controller in at least one of the optical transmission media wherein the phase controller is adapted to apply a phase adjustment to a respective one of the two path signals such that, at the optical coupler, substantially all of the power of the signal path components is produced at a main output and wherein a portion of the power of the noise path signals is diverted to a subsidiary output.

13. An optical amplifier according to claim 12 wherein an ASE power arising from amplification in the gain blocks is

substantially divided between the main output and one or more subsidiary outputs irrespective of the phase adjustment.

14. An optical amplifier according to claim 12 wherein the phase controller is further adapted to apply the phase adjustment in a manner that, at the optical coupler, external noise path components of the noise path components are at least partially incoherent resulting in at least a portion of external noise power being diverted to the subsidiary output.

15. An optical amplifier according to claim 12 wherein at least one of the gain blocks is an EDFA (erbium-doped fiber amplifier).

16. A multistage optical amplifier comprising the amplifier arrangement of claim 12 in combination with one or more optical amplifier(s).

17. A multistage optical amplifier according to claim 16 wherein the optical amplifier arrangement is a first stage of the multistage optical amplifier.

18. A pre-amplifier comprising the optical amplifier arrangement of claim 12.

19. A receiver structure comprising the pre-amplifier of claim 18 preceding an optical receiver.

20. An optical amplifier arrangement according to claim 12 comprising an additional phase controller.

21. An optical amplifier arrangement according to claim 12 wherein the optical splitter, the two OTM, and the output optical coupler together comprise a Mach-Zehnder interferometer.

22. An optical amplifier arrangement according to claim 12 applied to an optical signal comprising a plurality of equally spaced channels wherein any two consecutive channels with frequencies f' and f of the equally spaced channels differ by $\Delta f = f' - f$, and wherein an optical path length difference, ΔL_o, between the two path signals, substantially satisfies $\Delta L_o = KC/(2\Delta f)$, wherein $K = 1, 2, 3, \ldots$ and C is the speed of light in vacuum.

23. An optical amplifier arrangement according to claim 12 further comprising processing and sensing circuitry adapted to control the phase adjustment.

24. An optical amplifier arrangement according to claim 12 further comprising processing and sensing circuitry adapted to control gain in the gain blocks.

25. An optical amplifier arrangement according to claim 12 wherein the optical splitter is a 1x2 3-dB single-mode fused-fiber coupler.

26. An optical amplifier arrangement according to claim 12 wherein the optical splitter is a 2x2 3-dB single-mode fused-fiber coupler, wherein one of two inputs of the 2x2 3-dB single-mode fused-fiber coupler is terminated locally.

27. An optical amplifier arrangement according to claim 12 wherein the optical coupler is a 2x2 3-dB single-mode fused-fiber coupler.

28. An optical amplifier arrangement according to claim 12 wherein the OTM are wave-guides.

29. An optical amplifier arrangement according to claim 12 wherein the OTM are optical fibers.

30. An optical amplifier arrangement according to claim 12 comprising at least one additional optical transmission medium connected to the optical splitter and to the optical coupler for a total of M OTM.

31. An optical amplifier arrangement according to claim 30 wherein each one of the at least one additional optical transmission medium comprises a gain block.

32. An optical amplifier arrangement according to claim 30 wherein each one of the at least one additional optical transmission medium comprises a phase controller.